Which micronutrients control insulin resistance and diabetes complications?

You may be wondering how vitamins and minerals do this work, or which micronutrients are the most effective at protecting you from insulin resistance and diabetes. Though we can't delve into all the science here, if you're interested, you may want to pursue the answers to your questions by following links listed on our references page for this article. Here's a quick overview of just a few of the important vitamins and minerals to consider.

- ***Chromium*** has long been known to support insulin function. A review of recent studies shows that a specific form of chromium, known as *chromium picolinate*, produced beneficial effects in over 1500 diabetes patients. It reduces blood glucose, fasting insulin, cholesterol and lipid levels, making patients less dependent on diabetic medications and reducing their risk for disease complications.
- ***Magnesium*** is a key factor in the regulation of insulin and is one of the most common micronutrients found to be depleted in the cells and bloodstream of insulin resistant and type 1 and type 2 diabetes patients. It also tends to be lower in individuals who are under stress. A recent study that followed over 85,000 women and 42,000 men showed that intake of magnesium decreases the risk of getting type 2 diabetes. Moreover, this finding was independent of the subjects' other risk factors, which means that adequate magnesium stores appear to govern diabetes risk despite your BMI, level of activity, or family history!
- ***Manganese***. Why lower than normal levels of manganese found in diabetic people is not well understood. Some researchers think diabetes may cause the lower levels, while others that the lower manganese levels may cause the diabetes. Manganese may help protect LDL, the "bad" form of cholesterol, from becoming oxidized, the state in which it can lead to plaques in the arteries. Fortunately, manganese is a trace element that is easily found in food sources, but more research is needed to clarify how supplementation can help with diabetes and insulin resistance.
- ***Vanadium*** is a trace element that has been shown to help with the uptake and metabolism of glucose, lipids, and proteins, and to increase insulin sensitivity in cells. It appears to act at extremely low levels as a cofactor to enhance or inhibit enzymes in the body. Though present in such small quantities to be described as an "ultratrace" element by some, it is nonetheless considered by most researchers to be an essential element for human health. It is stored in the body's bones, and at excessive doses can disrupt bone and tooth development. There is no recommended daily amount for vanadium at this time, and it is generally recommended that you take less than 100 mcg per day.
- **B vitamins**

Over the years, I have found B vitamins to be deficient in many of my patients. Two of the biggest factors causing low levels of B vitamins in women are stress and birth control pills.

Vitamin B3 (niacin or nicotinamide). Hundreds of reactions in the body require nicotinamide, and it is vital for normal carbohydrate, fat, and protein metabolism. The large European Nicotinamide Diabetes Intervention Trial was designed to evaluate the potential of this form of vitamin B3 to halt or delay the development type 1 diabetes. Although it was *not* found to prevent type 1 diabetes, subsequent research on people at risk for type 1 diabetes indicates that nicotinamide does play a key role in immune regulation. It does this by reducing levels of a signaling molecule known as *IFN-gamma* . The links are not altogether clear, but this signaling compound has been implicated at multiple points in the progression of autoimmune diabetes.

Vitamin B6 (also known as pyridoxine) can protect you from diabetes related complications. It may also be able to improve glucose tolerance, particularly in gestational diabetes.

Adequate levels of B6, **B9 (folate)** , and B12 are necessary for normal metabolism of homocysteine. High levels of homocysteine cause metabolic dysfunction and are a major risk factor for overall mortality in type 2 diabetics. Low levels of folate can be a special problem in individuals with a certain genetic variation known as MTHFR, which regulates folate metabolism. Up to 18% of the US population may have this variant, which places them at risk for complications related to inadequate folate. This can be addressed by supplementing the diet with bioavailable forms of folate.

Vitamin B12 **(cobalamin)** is necessary for nerve cells to function properly. Ensuring adequate levels in the blood may help to prevent the nerve damage (known as *peripheral neuropathy*) that occurs with diabetes.

- ***Vitamin C (ascorbic acid)*** has protective effects on the kidney, as well as the eyes and the nerves. In people with diabetic hyperglycemia, it has been shown to prevent accumulation of a kind of sugar known as *sorbitol* that can lead to complications with these organs. Diabetics are found to accumulate high levels of sorbitol, leading the cells to "leak" important nutrient molecules such as vitamins, minerals, and amino acids. Summarizing the results of a clinical trial on insulin-dependent diabetes mellitus (IDDM), researchers considered vitamin C to be superior in normalizing sorbitol levels to drugs designed for the same purpose.
- ***Vitamin E*** is an important antioxidant that neutralizes the damaging free radicals produced during hyperglycemic states. Research findings on the value of vitamin E supplementation in preventing type 2 diabetes (primary prevention) are mixed, but have shown that people with vitamin E deficiency may be at a higher risk of developing it. Other trials do indicate that vitamin E supplements can reduce oxidative stress and improve glycemic control in patients who already have diabetes that is, for secondary prevention). Adding vitamin E to your diet may also prevent possible degenerative effects associated with vulnerable organs, such as the kidney.

- ***Selective kinase response modulators* (SKRM's).** While the science behind these special molecules is still young, SKRM's may turn out to be the cherry on top in regulating glycemic control without drugs. Kinases serve an important role in the body in regulating healthy insulin signaling and function. Recently, scientists have identified and isolated a group of botanical extracts known as *alpha acids*, two in particular — *RIAA* and *THIAA* — that work as selective kinase response modulators to significantly lower markers in the body that herald inflammation and metabolic dysregulation. SKRM's can be found in lots of organically grown fresh fruits and vegetables, but they're also now available in special supplements (for example, rosemary, hops, and *Acacia* derivatives) that people with insulin resistance can use in a dose-regulated fashion to reverse faulty cell signaling. (You can ask a functional medicine practitioner about these options.)

There are many other micronutrients currently under study in nutrigenomics, and many more waiting to be discovered. The above list describes just a few of the many thousands of ways micronutrients can help ward off and diminish the damage that chronic diseases like diabetes can wreak in the body. In reality we have so much more to learn about how they work, and how we can determine our unique individual needs on a daily basis.

So how much is enough?

Presently there remains far too much variability in the way researchers have designed their studies — and in individuals' own glucose control — to allow for set nutrient recommendations for everybody with insulin resistance and diabetes. Another complication is that the body's pool of some micronutrients is so tiny that it's very hard to assess how much an individual has or needs. As a result, the American Diabetes Association and the American Dietetic Association do not currently support supplements for diabetics outside the usual recommendations for healthy people.

Yet many healthcare providers are genuinely interested in full well-being for their patients and remain open to nutritional therapy for those at risk of insulin resistance and its ensuing complications. And in time, we expect a better understanding of how and why micronutrient therapy works.